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SPACE POWER SYMPOSIUM (C3)
Space-Based Solar Power Architectures / Space & Energy Concepts (1)

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STRATEGY OF INTRODUCTION OF PRACTICAL SPS UTILIZING EQUATORIAL ORBITS

Abstract

The Space Solar Power System (SSPS) that converts solar energy into electricity in space, and transmits energy by wireless power transmission (WPT) from space to the ground has been studied for around half a century. Many conceptual examinations and basic study on the SSPS were performed in various countries, including Japan, US and Europe. The first solar power satellite (SPS) concept was proposed by Dr. P.E.Glaser in 1968. In the 1970s, the most famous conceptual study on SPS was executed by NASA and DOE. SPS activity in Japan was started in the 1980s. Evaluation of the SPS concept was carried out from 1991 to 1993 sponsored by Japan's National Energy Development Organization (NEDO) and the ministry of International Trade and Industry (MITI). Also, in the '90s, SPS2000 was studied by the SPS2000 Task Team organized in ISAS. Also, many critical technologies toward SPS were studied. WPT is inherent technology of SPS, and WPT demonstrations on the ground and in space have been performed in Japan. Three sounding rocket experiments, MINIX in 1983, ISY-METS in 1993 and retro-directive experiment in 2006 were carried out. The objective of the rocket experiments of MINX and ISY-METS was to study nonlinear interactions of the microwave power beam in the space plasma environment and to demonstrate microwave power transmission. Technology demonstration on WPT on the ground were also performed. Kyoto University and Kobe University conducted MILEX in 1992, Kansai-demo in 1994, and, ETHER in 1995. JAXA and Jspacesystems conducted WPT demonstration experiment utilizing the phased array antenna system from 2008 to 2014. Each basic technology required for SSPS has been well defined and well developed through the past studies. However, strategic approach to the practical SPS has not developed. In order to launch the meaningful technology demonstrations and demonstration plants for the SSPS by means of space environments immediately continual buildup will be required. The equatorial orbits that include a geostationary orbit are critically useful to the SSPS. Many conceptual designs of the commercial and demonstration plants of solar power satellite (SPS) adopted the equatorial orbits. Also, researches of the equatorial region for rectenna site were carried out in the study of the SPS2000. We will describe the engineering utilization and social and diplomatic meaning during the development process toward the practical SPS using the equatorial orbit.